Greenest House
Energy Analysis

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Executive Summary

This energy report has been prepared to assess the potential improvement in energy usage and carbon emissions for the proposed Greenest House concept.

The concept proposes the refurbishment, extension and conversion of terraced single dwelling Victorian properties into two dwellings, with fabric upgrades and the incorporation of renewable technologies.

An energy assessment has been carried out based on concept design information to identify the most appropriate way to reduce CO_2 emissions and energy demand.

Following thermal and M&E equipment upgrades proposed, the energy strategy for the refurbished and extended building has been demonstrated to be capable of achieving an improvement of 90.54% CO_2 emissions over the scenario where the dwelling retains the existing fabric and extension using building regulation minimum standards, and an improvement of 75.32% over a typical refurbishment and extension of a terraced property using building regulation minimum standards.

1 Introduction

This energy statement has been prepared to demonstrate the potential carbon emissions and energy savings of the Greenest House concept.

This assessment is based on conceptual model of a typical Victorian terraced property before and after extension and refurbishment. As such, the actual energy savings and carbon emissions of any development following the Greenest House approach may be different from those reported. The baseline notional dwelling will also vary depending on individual cases of refurbishment and extension.

1.1 Assessment approach

This report summarises the work undertaken to support the energy strategy for the proposed development.

Standard Assessment Procedure for the Energy Rating of Dwellings (SAP) calculations have been carried out in order to assess the impact on energy demand and CO_2 emissions of improvements through the hierarchy and demonstrate the most appropriate solution for the proposed development.

The calculations for the proposed development has been compared to two scenarios. The first scenario is whereby an existing Victorian terrace retains all thermal and M&E elements and extends the property following building regulation minimum standards. The second scenario represents typical thermal and M&E upgrades on the existing building and extension, in line with building regulation minimum standards.

2 Energy Strategy

Building Fabric

Tables 3-1 below provides details of the existing thermal envelope and upgrades due to the refurbishment.

Fabric Component	Existing Dwelling Scenario Existing and Minimum Part L Specification for Extension	Typical Standard Upgrade Scenario Minimum Part L Specification Upgrades	Greenest House Scenario Efficient Specification Proposed
Existing External Walls	2.50 W/m²K	0.30 W/m²K	0.18 W/m²K
New Extension External Walls	0.18 W/m²K	0.18 W/m²K	0.15 W/m²K
Existing Roof	2.3 W/m²K	0.16 W/m²K	0.13 W/m²K
New Extension Roof	0.15 W/m²K	0.15 W/m²K	0.13 W/m²K
Existing Ground Floor	1.2 W/m²K	0.25 W/m²K	0.15 W/m²K
New Extension Floor	0.18 W/m²K	0.18 W/m²K	0.15 W/m²K
Windows	4.8 W/m²K G VALUE 0.85	1.4 W/m²K -	0.8 W/m²K G VALUE 0.57
Roof Windows	1.6 W/m²K	1.6 W/m²K	1.1 W/m²K
External Doors	3.0 W/m²K	1.4 W/m²K	1.4 W/m²K
Air Tightness	No test	-	5
Thermal Bridging	Default	-	Default

Table 2-1 Existing and proposed thermal fabric values

The existing specifications have been extracted from RdSAP Appendix S. The minimum Part L specifications have been extracted from Part L standards for new elements in existing dwellings and existing elements in existing dwellings. Where existing fabric is being renovated and exceeds the Part L threshold value, the improved U value has been specified as the minimum Part L specification.

Building Services

<u>Space Heating and Hot Water</u>

In the existing dwelling scenario whereby the existing fabric is maintained and minimum standards met for new elements, a gas boiler has been specified. In the scenario of a typical upgrade whereby fabric and M&E is upgraded to building regulation minimum standards, a gas boiler has been specified. Where significant thermal upgrades are not undertaken and the air tightness of the property is not significantly improved, an ASHPs efficiency would not be optimum, and therefore generally not recommended. The Greenest House proposes an Air Source Heat Pump, for which a preliminary specification of a Mitsubishi Ecodan 6kW has been included.

Ventilation

The existing dwelling scenario and typical upgrade scenarios both use natural ventilation. Where thermal upgrades are not undertaken, Mechanical Ventilation with Heat Recovery (MVHR) is generally not recommended, as it would not perform efficiently with high air leakage. The Greenest House proposal includes MVHR, due to the proposed thermal upgrades.

Lighting

All lighting internally and externally will be energy efficient and provided with adequate controls.

Services Component	Existing Dwelling Scenario Specification	Typical Standard Upgrade Scenario Specification	Greenest House Scenario Specification
Space Heating & hot water	Centralised gas boiler Radiators	Centralised gas boiler Radiators	Air Source Heat Pump (ASHP) Providing 100% Heating & Hot Water SCOP 3.56 Underfloor heating
Heating Controls	Thermostat	Thermostat Time and temperature zone control	Thermostat Time and temperature zone control
Ventilation	Natural	Natural Mechanical extract in wet rooms Air conditioning	Mechanical Ventilation with Heat Recovery SFP 0.96 Efficiency 90%
Lighting & Controls	0% low energy lighting No controls	100% low energy lighting Controls	100% low energy lighting Controls

Table 3-2 Existing and proposed building services measures

2.1 Energy and Carbon Savings

Energy Use

Table 3.3 provides a summary of the energy performance of the conceptual building after refurbishment, compared to the scenario in which the existing fabric is maintained and the minimum standards for the extension are met.

	Residential		
	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Existing Dwelling & Extension	8.03		
Proposed Building	0.76	7.27	90.54%

Table 3.3: Summary of SAP results

Table 3.4 provides a summary of the energy performance of the conceptual building after refurbishment, compared to the scenario in which the existing dwelling is typically upgraded and follows building regulation minimum standards for fabric and services.

	Residential		
	CO_2 Emissions (tonnes /annum)	CO_2 Savings (tonnes /annum)	% Saving
Typical Refurbishment & Extension	3.08		
Proposed Building	0.76	2.32	75.32%

Table 3.4: Summary of SAP results

3 Conclusion

Following the thermal and M&E equipment upgrades described, the energy strategy for the refurbished building has been demonstrated to be capable of achieving an improvement of 90.54% CO_2 emissions over the existing and extension scenario, and a 75.32% over the typical upgrade and extension scenario.